NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Activity 8.1A

**MORE SIMULATION**

Let’s say we wanted to draw one card (with replacement and shuffling) from a standard 52 card deck. However we want to use simulation to do this…

1. How can we assign digits (NUMBERS) to represent each card?
   1. First, how many different cards are there (not counting different suits, or colors, just different cards)?
   2. So what would you type into randInt()? randInt(1, )?
   3. Now let’s assign those numbers to the cards. What would you let an ACE be?
   4. What would you let a 2 be?
   5. What would you let a 3 be?
   6. What would you let 4-10 be?
   7. What would you let a JACK be?
   8. What would you let a QUEEN be?
   9. What would you let a KING be?
2. Let’s answer some basic questions first. For all answers, first write as a fraction out of 52, then convert to a percent.
   1. What is the chance of drawing a FACE CARD (jack, queen, king)?
   2. What is the chance of drawing a 3?
   3. What is the chance of drawing an even number card?
   4. What is the chance of drawing a queen?
   5. What is the chance of drawing an ace?
3. Now let’s simulate picking one card at a time from the deck (with replacing and shuffling in between). Use your answers from #1 to do this. Draw 200 cards from the deck. Record what each card is below:

|  |  |  |
| --- | --- | --- |
| **CARD** | **# of times drawn** | **TOTAL** |
| ACE |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |
| FACE CARD |  |  |
|  | **TOTAL** | 200 |

1. Calculate the experimental probabilities in the chart below *(total of each type of card ÷ 200)*. Then fill in the theoretical probabilities *(you found these in #2)*.

|  |  |  |
| --- | --- | --- |
| **CARD** | **Experimental Probability (in %)** | **Theoretical Probability (in %)** |
| FACE CARD |  |  |
| 3's |  |  |
| Evens |  |  |
| Queens |  |  |
| ACE |  |  |

1. Are your theoretical and experimental percentages close to each other?
2. What could we do to make the theoretical and experimental percentages closer to each other??
3. So let’s do this! Bigger sample size! Do another simulation, and “draw” 100 more cards. Tally your results in the chart below, and then make an overall total for each category (add your total from the first 200 draws to your total for this 100 draws)

|  |  |  |  |
| --- | --- | --- | --- |
| **CARD** | **# of times drawn** | **TOTAL** | **OVERALL TOTAL** |
| ACE |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| FACE CARD |  |  |  |
|  | **TOTAL** | 100 | 300 |

1. Again, let’s use our overall totals to re-calculate the experimental probabilities *(overall total for each card ÷ 300)*. Then fill in the theoretical probabilities again.

|  |  |  |
| --- | --- | --- |
| **CARD** | **Experimental Probability (in %)** | **Theoretical Probability (in %)** |
| FACE CARD |  |  |
| 3's |  |  |
| Evens |  |  |
| Queens |  |  |
| ACE |  |  |

1. Are the theoretical and experimental probabilities closer now? Or further away?

**NEW SIMULATION!**

Let’s do a quick simulation of flipping a coin. There are only 2 outcomes: HEADS and TAILS. We will let 1 be HEADS and 0 be TAILS, and use randInt(0,1). Before you start this experiment, clear out your L1.

1. What is the theoretical probability of getting HEADS (as a %)?
2. If I flip my coin 110 times, how many heads do I ***expect*** to get?
3. If I flip my coin 110 times, what is the longest run (streak) of HEADS do you think you will get? (How many times will you get HEADS in a row?)
4. We want to “flip” our coin 110 times. To do this, type the following into your calculator:

randInt(0, 1, 110) 🡪 L1 *(the arrow is the store button, its above the ON button)*

and then hit ENTER. This will generate 200 “flips” and store them in L1 for you.

1. Look in L1 at your “flips.” Scroll down L1 and find your longest run of HEADS (1’s). What is it?
2. Let’s calculate the number of heads that we “flipped.” We can do this easily since HEADS are 1 and TAILS are 0. So we can just sum (add up) the numbers in our list, and this total will be the number of HEADS. Sum L1 by doing the following:

Go to 2ND STAT, then MATH, then #5:sum(, then ENTER, then type in sum(L1) and hit ENTER.

How many HEADS did you get? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the experimental probability of HEADS (write as a %)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How does this compare to your theoretical probability?

**ANOTHER NEW SIMULATION!**

For this simulation, we will be “rolling a dice.”

1. What are the possible outcomes when you roll one dice?
2. What is the theoretical probability of rolling a 1? How about a 2? The other outcomes? *(What percent of the time SHOULD you get a 1, 2, etc.)*
3. If I roll the dice 210 times, how many times should I get each outcome?
4. We want to use randInt() and simulation to “roll” the dice. What numbers should we put into randInt() and what numbers should we let represent each outcome?

Outcomes represented by:

randInt( , )

1. Using your answer to the previous question, use randInt() to “roll” your dice 210 times and record your results in the chart below:

|  |  |  |  |
| --- | --- | --- | --- |
| **outcome** | **# of times** | **total** | % |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
|  | **total** | **210** | 100% |

1. How do your experimental probabilities (percents) compare to your theoretical probabilities?
2. What could we do to make the experimental and theoretical probabilities closer to each other?
3. How big of a sample size do you think we will need to make these probabilities very close?
4. Let’s get class data! Add your data to the board and record your classmates’ data in the chart below. Calculate the class totals and the experimental probabilities for the class. Are these closer to the theoretical???

|  |  |  |
| --- | --- | --- |
| **outcome** | **class total for # of times** | **Experimental %** |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
|  | **total** | 100% |